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ABSTRACT

CONDUIT reviews and packages computer-based materials as alternative methods of teaching in higher education. Curriculum areas include biology (4 packages), chemistry (3), management science (9), mathematics (2), physics (6), and social science (17). This catalog individually describes the programs including suggested previous coursework, specific subject areas emphasized, an abstract of the problem posed, and anticipated results. A price list and ordering information are included. (JAB)

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CONDUIT CURRICULUM MATERIALS

What are they?

The CONDUIT "Reviewed and Tested Curriculum Materials" are made available in the hope of providing instructors with reliable, easily used, alternative methods of teaching for higher education. These computer-based materials have been recommended by educators, tested for technical reliability by computer experts, and packaged for use at academic institutions with varying computing facilities.

The continuing activity of CONDUIT, through its Curriculum Advisory Committees, is to search for materials and select those thought to be appropriate for use in undergraduate instruction. These materials are then reviewed by discipline experts and, when possible, by instructors who have used the materials in the classroom. Using the information collected during the review, the Advisory Committee then provides CONDUIT with an evaluation of the potential instructional value of the materials and their appropriateness for widespread use. This review process serves to identify materials meriting the investment of the resources to package it for transfer. Generally, materials considered unsuitable are either trivial (an inappropriate use of computers in teaching); conceptually incorrect (the substantive content of the programs is erroneous); or erroneously programmed (the program's algorithm does not faithfully represent the theory).

The "packaging" of materials is an attempt by CONDUIT to provide instructors with the complete information and materials they will need to make effective use of the unit in the classroom. A three year CONDUIT study revealed that the majority of existing materials could only be transferred from the originating site with non-trivial modifications to the programs and a significant expenditure of time and personnel. CONDUIT's "packaging" increases the probability of successful transfer by eliminating many of these problems. The program code is modified to meet transferable standards thus eliminating the majority of machine dependent features of the program; and tested to verify the program's performance. Complete supporting educational and technical documentation is provided to assist the instructor in implementing the programs on the computer and in the classroom.

The abstracts for the CONDUIT "Reviewed and Tested Curriculum Materials" included in this Catalog are intended to provide the potential adopter with information as to the package's 1) instructional intent, 2) mechanics of use in the classroom, and 3) technical (machine) requirements for implementation at a local site. Each package is described in the abstract by:

1) mnemonic and/or descriptive title;
2) content descriptors;
3) CONDUIT Registry#, language, computing mode;
4) author, publisher;
5) subject matter covered, mechanics of use;

6) contents of the package including manuals and software.

How do you order a package?

A price list and forms for ordering packages are included in the back of this Catalog. The order form and customer agreement must be completed before CONDUIT can process your order. CONDUIT requests that our customers:

1) agree not to redistribute these computer programs and associated textual material.
   An important goal of CONDUIT is to insure authors' rights by honoring copyright laws.

2) agree to supply CONDUIT, on request, with additional information on the success of your implementation and use of these materials.
   As an organization responsive to the needs of our users, feedback is of critical importance to us. Also, as an NSF-supported organization, we are accountable for the "success" of our materials in meeting the needs of the academic community.

3) provide us with a brief description of your computer.
   This information is necessary so that we can create a magnetic tape (for transferring the computer programs) which meets the specifications of your computer. This information also allows us to draw some conclusions about the technical requirements of our user group and, therefore, is even important for "text only" orders (orders for texts in which the listings of the programs are included, thus not requiring a magnetic tape).

The elements of each package are listed in the abstract. Each unit typically includes: documentation (student manual, instructor's guide, technical documentation, abstract); software in a transferable form; and instructions or notes to implementers for installing the software on your computer. The documentation components of each unit will vary, especially in the case of commercially published manuals or materials from other secondary distributors. In many cases, publishers provide an instructor's manual which is only available (at no charge) to bona fide users (instructors) of the text. CONDUIT has been unsuccessful in procuring copies of these manuals and must rely on each instructor to request a copy from the publishers. These manuals often include essential information for use of the package.

The source code for each program has been written to meet standards to insure its transferability. For FORTRAN, the adopted standard is ANSI FORTRAN (American National Standards Institute Document X3.9 - 1966), as defined by PFORT described in Bell Laboratories Computing Science Technical

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Insert following page iv.

Report #12 by B.C. Ryder and A.D. Hall, Murray Hill, New Jersey. For BASIC, the conventions followed are based upon "BASIC Revisited: An Update to Interdialect Translatability of the BASIC Programming Language" by Gerald L. Isaacs, CONDUIT, 1976. Software may be available in printed form in the manual or on magnetic tape. On request CONDUIT will provide software on other medium such as cards, cassettes, and paper tape.

CONDUIT will provide programming support for implementation of the materials for a minimum of six months from purchase and inform the purchaser of any corrections which need to be made. CONDUIT guarantees that the curriculum materials will operate as described.

Enhancements and corrections made to Reviewed and Tested Materials by users should be reported to CONDUIT for possible distribution to our user group.

BIOLOGY

COEXIST
(population dynamics)

Suggested Courses: General Biology

#BIO118 Interactive BASIC

P.J. Murphy, Chelsea Science Simulation Project, Chelsea College, London, 1975.

Population dynamics is the study of the changes that occur in the size of populations over periods of time, and the factors that influence these changes. It is not a topic that can easily be taught experimentally since it entails the maintenance of large numbers of organisms over many generations and is subject to the complex, and not always apparent, interaction of environmental and other influences.

COEXIST is an attempt to overcome these problems by providing students with the facility to simulate two biological situations. In the first, up to three populations are modelled to grow quite independently on identical limited food resources. The student is able to investigate the situation in which organisms compete only with members of their own species. When the outcome of such competition is familiar to the student, COEXIST can then be used to simulate two populations in competition with each other for the same limited resources. In each of the simulations, the student controls a number of parameters which might influence the outcome of competition by systematically choosing values for the number of offspring, generation times, initial and saturation problems and inhibiting factors. Investigations can also be performed to determine the relative effects of altering these parameters.

Students' Notes (15 pages); Teachers' Guide (15 pages); software (interactive BASIC program, 280 lines of code).

ECOLOGICAL MODELING
(ecology, ecosystem, population growth)

Suggested Courses: Introductory Ecology, General Biology

#BIO063 Interactive BASIC

Wm. Reiners, Wm. Glanz, and Stanley Cornish, Dartmouth College, Hanover, N.H., 1973.

This package of eight BASIC programs and accompanying text is designed for use in an introductory ecology or biology course. There is a sequence of increasing complexity in the textual presentation of the programs. Population growth is first considered as unlimited growth of a single species in the programs EPOP (34 lines of code) and EXPOP (39 lines of code). Each of these traces exponential growth of a population, but differs in the method of computation. EPOP uses an analytical solution for the differential equation. EXPOP uses difference equations for incrementing growth.

In succeeding programs, additional factors are introduced: environmental carrying capacity (SIGPOP, 40 lines of code), random environmental factors (RAND-K, 45 lines of code), and competitive interaction between species (COMPET-1, 52 lines of code). COMPET-2 (66 lines of code) is a modification of COMPET-1 which produces a graph of the results. COMPET-5 (100 lines of code) combines a randomly-varying carrying capacity and a migration program with the fundamental program of COMPET-1. TUNDRA (200 lines of code) simulates the growth and interactions of trophic levels within an ecosystem.

Student Manual (57 pages); software (8 interactive BASIC programs, ranging in size from 34 to 200 lines of code).

EVOLUT
(natural selection, genetics)

Suggested Courses: General Biology

#BIO082 Interactive BASIC

S. McCormick, Chelsea Science Simulation Project, Chelsea College, London, 1975.

Given the complex genetic make-ups of higher organisms controlling the range of external and internal characteristics, natural selection becomes difficult to teach by traditional methods. The subject is further complicated since not all characteristics are controlled by a single gene, and not all genes produce a single characteristic. In order to study the effect of natural selection on one gene (or set of alleles), the situation can be simplified by setting up a model of a wild population, in this case, the well-known "Pea Model".

Unfortunately, the process of counting colored peas is too tedious, time-consuming and prone-to-error to enable investigations to be carried into more than one or two generations. A far quicker means of obtaining results, without error, by the same process is by using a computer program. Students can vary the type of selection (against one homozygote, both homozygotes, the heterozygotes), the degree of selection, and the size and composition of the initial population, and then follow the course of natural selection for as many generations as desired.

The students' appreciation of the action of natural selection is enhanced by the realization that relatively small differential survival rates are sufficient, over a number of generations, to alter the balance of a population. It will be appreciated that differential survival occurs, some forms surviving in preference to others. An elementary knowledge of genetics is assumed, particularly an understanding of (a) alleles, dominance and recessiveness, homozygotes and heterozygotes, (b) ecological habitats, and (c) percentages.

Students' Notes (19 pages); Teachers' Guide (11 pages); software (interactive BASIC program, 260 lines of code).

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LINKOVER
(genetic mapping, Mendel's laws, genetic linkage)

Suggested Courses: General Biology

#BIO122 Interactive BASIC

P.J. Murphy, Chelsea Science Simulation Project, Chelsea College, London, 1975.

Genetics is a part of biology in which it is sometimes difficult to arrange adequate practical work. Genetic mapping for example, involves the breeding of large numbers of organisms, which puts the practical teaching of this topic beyond the resources of most biology departments. But the understanding of genetic mapping can only be assured if the student can construct a map from breeding data. Breeding experiments themselves entail too much time and the maintenance of too many organisms for more than a trivial amount of data to be collected. On the other hand, data derived from literature is deterministic and involves the student to only a small extent.

These problems can be overcome by simulating mapping experiments on a computer. LINKOVER has been designed to allow students to plan and execute a program of experiments so that an accurate genetic map of the single chromosome of the "electronic species" can be drawn. An important part of this simulation is the challenge it affords students in planning the genetic crosses themselves. This provides a good opportunity for the class to operate as a team, or several teams, with the teacher being there to offer help only when it is required.

Students should have an understanding of the principles of Mendelian inheritance and should be introduced to the theory of linkage and genetic mapping before using the materials. Premature use of the simulation by students will only confuse them. Linkage and genetic mapping are explained in the student manual which also includes 7 exercises leading to use of the computer simulation.

The student's investigation is a two stage process:

(1) selection of gene combinations either alphabetically or otherwise until the sequence of genes in the linkage group has been established; and
(2) selection of adjacent genes so that the distances separating the genes can be accurately calculated.

Students' Notes (11 pages); Teachers' Guide (15 pages); software (interactive BASIC program, 380 lines of code).

CHEMISTRY

PRSTLW - FIRST LAW OF THERMODYNAMICS
(thermodynamics)

Suggested Courses: General Chemistry, Introductory Physics, Physical Chemistry

#CHM081 Batch or Interactive FORTRAN

Wallace H. Baird. Revised by J.B. Denk, CONDUIT, Iowa City, IA., 1974.

PRSTLW is a tutorial program designed as an investigative, out-of-class assignment for students in introductory chemistry and physics courses as well as in physical chemistry courses. The program is designed for exploring the relationship of an ideal gas with the First Law of Thermodynamics, a law which relates a state function--change in internal energy (ΔE)--to the heat absorbed by the system (q), and the work done by the system (w), i.e., $\Delta E=q-w$. Since the state function, ΔE, remains identical for any path from the initial to the final state, and different total q and w values for various paths produce the same overall ΔE, the user can use any combination of adiabatic, isobaric, isochoric, or isothermal steps to define a path for an ideal gas to reach a prespecified state. One of these four steps is selected by the student, and then the initial and final conditions of the gas, the molar heat capacity of the gas at constant pressure, the number of moles of a gas, and one end-of-step condition is specified. By successive selection of steps, a final state is reached.

Using this program in the interactive mode allows the student to investigate the First Law of Thermodynamics through multi-path calculations of internal energy, heat, and work for an ideal gas. This program demonstrates the First Law mathematically and instructs the student in computations of energetics and the Carnot Cycle.

Manual (36 pages); software (batch or interactive FORTRAN program, 950 lines of code).

IDGAME: QUALITATIVE ORGANIC IDENTIFICATION GAME
(organic qualitative analysis)

Suggested Courses: Organic Chemistry

#CHM011 Batch or Interactive FORTRAN

F.M. Hornack, N.Hetzel and M. Hepler, CONDUIT, Iowa City, IA., 1975.

IDGAME is a qualitative organic identification game designed as an aid to teaching organic qualitative analysis. The goals of the program include (1) the opportunity for a "dry lab" supplement for experimental organic qualitative analysis in order to expose the student to the strategies involved in identifying an unknown organic compound; (2) the reduction of the number of unknowns that would be treated in a "wet" laboratory; (3) the introduction of optimization concepts through a gaming technique by which minimum cost for identification is used as a measure of optimization; and (4) the introduction of factual industrial analysis costs in order to bring economic relevance to chemistry education.

The instructor selects one or more unknowns from the 20 compounds available in the data base and assigns them to one or more students who then pursue the identification of the unknown by making computer runs to get simulated laboratory test results. The compound name itself is not available as output from the game but only the analytical results to the 41 tests which can be requested. Since each test incurs a cost, the student compiles a total cost for the requests and a number of individual students or teams of students can then compete for minimum cost on the identification of an unknown. (Instructor control of student output is necessary in this method of implementation since the program does not include a cumulative accounting for all jobs run by a particular student or student team.) Cost information is included in the output after each computer job. Nine consultation services for student guidance are also available as output from IDGAME.

The user should be familiar with the chemical principles involved in measuring physical properties, solubilities, elemental analysis, classification test, and the use of derivatives. Since data can be purchased for infrared, ultraviolet, mass and nuclear magnetic resonance spectra, fundamental interpretation of these spectral types could be a requirement if the instructor wants these tests used. However, spectral analysis is not essential to identifications and this ability for interpretation is not necessary. The chemistry prerequisite for usage should be the same as those required for beginning laboratory classes. No programming knowledge is necessary for either student or instructor when the package is used in its present form. Some programming knowledge will be required if an instructor enters a new unknown into the data base of currently available unknowns.

Student, Instructor and Programmer Manuals (52 pages); software (interactive or batch FORTRAN program, 1500 lines of code, and 3 data files, 200,249 and 65 lines of data).

NEUTRON ACTIVATION ANALYSIS
(neutron activation, half-life, radioisotopes)

Suggested Courses: Physical Chemistry, General Chemistry, Nuclear Chemistry

#CHM119 Interactive FORTRAN

Ted Hopkins, CONDUIT, Iowa City, IA., 1976.

Neutron Activation Analysis is based on a program RADIO, included in the text "Numerical Methods in Chemistry" by K. Jeffrey Johnson and simulates an experiment performed at the Radiation Center, Oregon State University. In this experiment, a short length of wire (an alloy of aluminum and indium) is activated by neutron bombardment in the TRIGA reactor. The radioisotopes which are produced each decay with different half-lives. The total decay curve for sample wires of different compositions are calculated and plotted by the simulation. The half-lives and initial activities of the various samples can be determined by students analyzing the curves.

The user chooses a sample number, decides how soon to begin counting the sample after ejection from the reactor, and determines details about counting the sample (e.g., counting times, intervals, duration). The total count rate calculated by the simulation is given an appropriate scatter through the use of a random number subroutine. The data are then presented in tabular form followed by a log plot of activity-versus-time for the same data. The log plot enables the student to immediately decide whether proper decisions were made with regard to the counting parameters for the sample that had been assigned. The experiment can then be redone if changes need to be made.

This unit is suitable for students in beginning courses in physical chemistry and has the following learning objectives:

To determine the half-lives of two radioactive species decaying together.
To determine the relative amounts of the two species.
To observe the effects of changing the counting intervals and duration of counting times.
To observe the effect of random fluctuations in the counting rates on the analyses.
To identify the advantages and disadvantages of neutron activation compared to other analytical techniques.

The realization of these objectives depends only in part on the simulation itself. The instructor's role in selecting the initial sample data for the simulation, and in supplementing the discussion of topics in the Student Manual is crucial. First year general chemistry students should have studied course work related to radioactivity before using the program. The program should be particularly useful as supplemental work for laboratory courses in physical, nuclear and general chemistry. No prior computer experience is needed by the student.

Student Manual (21 pages); Teacher's Guide and Technical Documentation (32 pages); software (interactive FORTRAN program, 870 lines of code).

ECONOMICS

COMPUTER SIMULATION POLICY GAMES IN MACROECONOMICS
(macroeconomic policy)

Suggested Courses: Intermediate Macroeconomics, Principles of Economics

#ECN043 Interactive BASIC and FORTRAN

Richard Attiyeh, CONDUIT, Iowa City, IA., 1976.

These six macroeconomic policy games attempt to convey to the student an understanding of the aggregate behavior of the economy by casting him in the role of economist and policy maker for a simulated, real world economy. Each game uses a time series model or "history" of the economy to inform the student of past behavior of the model. In choosing values for the policy variables, the student learns the value of economic analysis; in trying to identify and understand the structure of the model, the student applies economic theory; and in playing the game, the student appreciates the usefulness of economic theory in understanding economic events. Each of the following six games vary in the complexity of the hypothetical economy, the goals provided the student, and the aspects of macroeconomics being emphasized.

MPG-I
In this game the student manages fiscal policy in a simple model of the product market with the goal of keeping aggregate demand at or near potential output. (170 lines of BASIC code)

MPG-II
The goal of this game is to minimize the difference between aggregate demand and potential output by student control of government expenditures and marginal tax rate. (170 lines of BASIC code)

MPG-III
This game incorporates a money market and a factor market with the product market and involves the student in simultaneous decisions about several policy variables in pursuit of multiple targets defined by the welfare function. (210 lines of BASIC code)

MPG-IV
The structure of the model for this economy is identical to that in MPG-III except policy decisions affect both the balance of trade and the balance of payments. (180 lines of BASIC code)

MPG-V

In this game the student is provided with increasingly complex goals beginning with a social welfare function in which the only argument is the deviation between actual and target income and concluding with a function involving deviations between actual and target rates of unemployment, inflation, and interest. (310 lines of BASIC code)

MPG-VI

This game is basically the same as MPG-V. It includes the nature and sequencing of policy goals, types of fiscal policy decisions available to the student, and the fixed interest rate regime; however a more realistic monetary sector is incorporated, teaching the standard theory of money supply and demand. (365 lines of FORTRAN code)

Each of these models casts the student or student team in the role of policy maker whose decisions are based upon historical information about an economy and some stated objective. The computer develops the problem and requires student response, evaluates reasonableness of answers, and finally reports on successfulness of student decisions. These models can be used with introductory, intermediate, or advanced students although the complicated models are more suited to students who have nearly completed a semester introductory macroeconomics course or are taking an intermediate course.

Student Manual (28 pages); Instructor's Manual (159 pages); software (5 interactive BASIC programs, ranging in size from 140 to 340 lines of code, and 1 interactive FORTRAN program, 665 lines of code).

MANAGEMENT SCIENCE

BUSINESS MANAGEMENT LABORATORY
(business policies, production management, financial management, marketing management)

Suggested Courses: Business Policy, Introductory Business

#MSC055 Batch FORTRAN

R.L. Jensen and D.J. Cherrington, Business Publications, Inc., Dallas, Texas, 1973.

This simulation presents a stylized model of a flatware manufacturing industry with up to eight competing firms. The model is intended to teach firm interaction, emphasizing management techniques for balancing all functional areas of the business. Several instructional purposes may be served by this simulation, which (1) allows participants to experience real-world-like consequences of decisions, (2) evaluates a long series of decisions quickly, (3) forces the participant to consider all aspects of business (e.g., marketing, finance, production, and administration), (4) minimizes gaps and overlaps in the presentations of concepts, and (5) motivates active participation and interest in the learning process.

Firms are managed by teams of students who "replace" the previous management. Each team competes for the product market of the flatware industry starting from essentially the same position and dealing with the same product. Not all decisions are remade for every period; areas of concern include marketing aspects, plant and production, and finance and administration.

Goals are established for the teams by the game administrator. The simulation can be varied in complexity by the administrator and thus is adaptable to various situations, e.g., introductory level management and business courses, graduate level policy courses, executive development conferences, and in-company training programs.

Student Manual (35 pages); Administrator's Manual (58 pages) available from publisher; software (batch FORTRAN program, 1400 lines of code, with modified history file handling which eliminates need for punched cards).

COMPUTER AUGMENTED CASES IN OPERATIONS AND LOGISTICS MANAGEMENT
(operations management, operations research, production management)

Suggested Courses: Production Management, Operations Research and Management, Marketing Management, Quantitative Methods

#MSC008 Batch FORTRAN

Wm. L. Berry and Clay D. Whybark, Southwestern Publishing, Cincinnatti, Ohio, 1972.

The Berry-Whybark package is a group of cases for use in operations and logistics management at the advanced undergraduate or MBA level. The cases and associated programs are:

Centerville National Bank
This non-computerized case serves as an introduction to simulation. It is also used to introduce the concept of an operating system in a non-manufacturing environment.

Murkee Mining Company
This non-computerized case serves as an introduction to using simulation as an aid in designing and comparing decision rules for equipment maintenance. It can be used to illustrate hand simulation techniques and to provide the basis for discussion of maintenance policies.

McAllister Corporation (A)
This case illustrates the use of in-process inventories along an assembly line, introduces time study data, and presents a hand simulation to show the effect of variance in operation times on production.

McAllister Corporation (B)
A major purpose of this case is to serve as a simple introduction to the computer programs that are used for other cases in the text. The data required for the program are simple (a single number), and the degree of pre-analysis is limited. A second objective of this case is to illustrate the trade-off between in-process inventory and idle time for the operators on an assembly line. (366 lines of code)

Hornby Products Company
This case provides the opportunity to use a computer program to investigate the costs of alternative warehouse systems in serving a new region. The program can be used to develop the total cost as a function of the number of warehouses in the system, to apply a heuristic rule, or to evaluate intuitive plans. The trade-offs between number of warehouses, costs, and customer service can be discussed. (485 lines of code)

Hutchinson Gas Service Company
This case illustrates the problem of determining which customers to serve from which facilities--a problem that can be treated by the transportation method of linear programming. It also illustrates the need for a careful specification of the alternatives to be compared when making capital investment decisions. The objective is to show that, before considering a new investment that will reduce operating costs, all improvements in the current operating system should be investigated first to provide the appropriate basis for comparison. The transportation method of linear programming (or careful work with the computer program) will show what these improvements are before making a comparison with the costs of using a new facility. (281 lines of code)

Leland Company
The primary objective of this case is to introduce the concepts of forecasting by using a simple exponential smoothing model. Hand calculations of forecasts for several periods and forecast error measures are used. The case is used also to introduce the question of choosing criteria for evaluating forecasting performance and the procedure for determining the initial estimates for the model's starting values.

CRO DEL MAR (B)
This case introduces an exponential smoothing model for forecasting which incorporates trend and seasonal factors. The computer program is used for investigating the effect of changes in the parameters on various criteria of forecast accuracy. (175 lines of code)

CRO DEL MAR (B)
This case presents an aggregate production planning problem. Monthly forecasts of sales are available, and the computer program computes the total annual cost of production plans that are specified in terms of monthly production and manpower for a one-year planning horizon. (169 lines of code)

NATCO (A)
This case introduces the student to the problems of scheduling production in a job shop. It illustrates how the preparation of a detailed production schedule can aid in making effective use of production capacity and making on-time deliveries to a firm's customers. The case can also be used to motivate the use of decision rules for routine decisions such as dispatching and product mix determination.

NATCO (B)
This case presents the problem of selecting a decision rule for scheduling the machine operations in a job shop. It describes several production scheduling rules and illustrates the use of computer simulation in comparing the performance of alternative scheduling rules. An important objective in this case is to compare the traditional measures of scheduling

rule performance, such as order lateness or job flow time, to the firm's profits. (777 lines of code)

NATCO (C)

This case introduces the problem of setting customer delivery promise dates and controlling the amount of work-in-process inventory in a job shop. It also illustrates the use of simulation to search for good parameter values for decision rules. In this case the decision rule parameter values to be determined are (1) the "desired" level of the work-in-process inventory, and (2) a factor to be used in determining the delivery dates for customer orders.

MID-AMERICA BAKERIES, INC.

This case provides an introduction to the problem of developing delivery routes from a central facility to several customers. It illustrates both the complexities of developing routes and the problem of competing criteria. Three criteria are introduced: total travel time, the number of trucks required, and balancing the work load among the trucks. An example scheduling rule is shown and students are requested to develop routes of their own. The problem of limited time availability for each truck serves as a constraint, and the difficulty of programming the logic of route development is pointed out. The case can be followed by discussing analytic approaches to the vehicle scheduling problem.

THE GAMING COMPANY (A)

This case is used to illustrate the nature of inventory decisions and the usefulness of even a moderate amount of inventory theory for improving the performance of an inventory manager. Other topics included are economic order quantities, decision rules, and competitive game simulations.

THE GAMING COMPANY (B)

This case is used for illustrating different types of decision rules for inventory management and comparing their performance. It also demonstrates the use of computer simulation to perform a search for good parameters for the decision rules. (292 lines of code)

NICHOLAS GARAGE

In the Nicholas Garage case the student is introduced to an adaptive smoothing technique which is a refinement of the exponential smoothing approach to forecasting. He also encounters an integrated forecasting-inventory control procedure. The case can be used to have the student evaluate three different forecasting procedures and to compare their performance in making inventory decisions. (420 lines of code)

NATCO (D)

Natco (D) is an integrative case which presents both the problem of inventory management and the problem of production scheduling. It has been

designed as a capstone case following the assignment of the Natco (A), Natco (B), and The Gaming Company cases. The case may be used to achieve three objectives: (1) to illustrate the effects of changed inventory control and production scheduling decision rules on the overall performance of a shop and its associated inventory system; (2) to illustrate the impact of alternative production scheduling rules on the choice of lot size and reorder point parameters in a two bin inventory control system; and (3) to illustrate the individual contributions of inventory theory and simulation in developing effective decision rules for an inventory system. (775 lines of code)

LODGE-ISTICS WEDDING (A) AND (B)

The Lodge-Istics Wedding (A) case provides a project planning situation in which the student should structure a network diagram, find the critical path, and do some time/cost trade-offs to meet a scheduled deadline. The (B) case provides a series of control problems which necessitate some replanning to keep the project on schedule.

MOHAWK MARINE PRODUCTS COMPANY

This case presents a situation in which the student can use decision tree analysis to select an attribute acceptance sampling plan. The analysis involves structuring a tree diagram, determining the appropriate cost and probability values, and computing the expected cost for each decision alternative. This case can also be used to introduce the expected value of perfect information measure and to show how it can be used in selecting an attribute acceptance sampling plan.

MARQUIS MANUFACTURING COMPANY

This case introduces the student to a process control problem that is combined with acceptance sampling plans in a customer's plant. The case provides an opportunity to review acceptance sampling plans from the standpoint of trying to supply a product that will pass a customer's inspection procedure. In addition, there is a possibility for in-plant inspection to help control the quality of the product. The economics of the control process is specified and used as the criteria function in a simulation of the quality control system. There are several sampling possibilities and information flows that provide a rich set of alternatives to be evaluated. The student can analyze these alternatives in a computerized two-firm, total-system environment. (440 lines of code)

Student manual (325 pages); Instructor manual (144 pages) available from publisher; software (10 batch FORTRAN programs, ranging in size from 160 to 800 lines of code).

COMPUTER MODELS IN OPERATIONS MANAGEMENT
(management analysis, production management, operations management)

Suggested Courses: Operations and Systems Analysis, Production Management and Systems, Marketing Management

#MSC007 Batch FORTRAN

Roy D. Harris and M.J. Maggard, Harper & Row, N.Y., N.Y., 1972.

This package consists of cases and accompanying computer programs used to demonstrate quantitative techniques for management analysis and decision making. The purpose of the models is to introduce students, at the undergraduate or graduate level, to use of the computer and quantitative techniques as a manager's tool in production, operations management or quantitative methods. No computer programming is required; students can use the programs as "black box" problem-solving tools.

Each chapter of the text presents (1) theories and concepts of the model, (2) a simple hand-computed example, (3) sample input/output, (4) more complex problems, and (5) program listings. The student is assigned a problem, analogous to a case presented in the text, and makes independent use of the program and techniques described. Use of the computer is intended to allow the student to concentrate on the structure of the problem, the data required and analysis of the results for cases of realistic complexity. The computer programs include:

FUTURE
Statistical forecasting model (405 lines of code). Computes forecasts by the statistical methods of mean, regression line, seasonal averages, moving average, and exponential smoothing.

INSYS
Inventory system model (200 lines of code). Computes inventory levels and factory output for a factory-wholesaler-retailer inventory system. Inventory replenishment and lead time policies may be changed in order to test the effect of these policies on the performance of the overall system.

EOQ
Model for inventory ordering policy (251 lines of code). Computes the most economical inventory order quantity under a variety of conditions, including price discounts, shortage cost, and storage limitations.

DECIDE
Decision tree analysis model (288 lines of code). Solves decision problems which are structured as a decision tree with both decision branches and chance event branches. The probability of each chance event must be given. If interest rates are included (optional), DECIDE will

include present value computations in determining the best decisions based on the expected present value of that decision.

CRIT
Project scheduling program (331 lines of code). Solves project scheduling problems which are formulated in terms of a network. This is popularly known as the PERT or CPM scheduling method. The input to CRIT consists of the project activities, their time estimates, and the precedence relationships. The output is the total project time, float for each activity, and the critical path.

BALANCE
Assembly line balancing program (566 lines of code). Contains five different heuristic decision rules which will solve assembly line balancing problems. The user must choose whether to set the desired number of stations in the solution or to set the desired cycle time.

SQC
Model on statistical control charts (246 lines of code). Computes the control charts for the mean and range of a group of sample data. Based on the computed control limits, SQC will indicate whether the process is in or out of control.

BEARSIM
Maintenance policy simulation (350 lines of code). Demonstrates how various maintenance policies for a particular maintenance situation may be evaluated through the use of the Monte Carlo simulation technique.

QUESIM
Model for queueing systems (503 lines of code). Simulates single-phase, multiple-channel queueing systems. The performance of one to nine channels may be investigated under a variety of arrival and service parameters and for a variety of associated costs.

UNISIM
One-product company simulation (403 lines of code). Simulates the decisions faced by the operations manager in a one-product company. The basic decision is the level of scheduled output, but the user may also specify automatic adjustments to this scheduled level. The effectiveness of the decisions may be tested against three different demand patterns for thirty-six periods.

Student manual (219 pages); Instructor manual (50 pages) available from publisher; software (10 batch FORTRAN programs, ranging in size from 200 to 600 lines of code).

EXECUTIVE GAME, THE
(financial management, accounting, marketing management, production management, business policies)

Suggested Courses: Business Policy, Introductory Business, Microeconomics

#BSC054 Batch FORTRAN

Richard C. Henshaw and James R. Jackson, Richard D. Irwin, Inc., Homewood, IL., 1972.

The Executive Game package consists of a computer-based simulation XGAME, a year end analysis program XRATE, and a student text that presents the concepts utilized by the programs and instructions for using the programs.

XGAME is a simulation designed to introduce students to the role of top management, requiring them to deal simultaneously with decisions in production, marketing, finance, competition, etc. Playing the game requires quantitative ability and develops qualitative judgment as well.

The game administrator has two options in use of this package: (1) selection of model 1 which is a simple version appropriate for lower level, introductory business courses, or (2) selection of model 2 which is more complex and suitable for upper level, graduate courses and executive development programs. For effective use of model 2, the student must have some background in basic accounting, marketing, financial procedures, and significance of economic indices.

Students are organized into teams of, ideally, four members who operate hypothetical companies in competition with each other. Teams must make quarterly decisions on:

- price of product
- marketing budget
- research and development budget
- maintenance budget
- production volume scheduled
- investment in plant and equipment
- purchase of materials
- dividends declared.

The following information is output for XGAME for each team:

- information on competitors (price, dividends, sales volume, net profit)
- sales potential
- sales volume
- inventory of finished goods
- plant capacity next quarter
- income statement
- cash flow
- balance sheet.

Two years of dynamic business experience can be gained in a period of play lasting from one day to two months. Outcomes are determined by the interactions within and between participating teams and the economic

structure which is programmed into the computer. The recommended goal for each team is maximization of the rate of return earned on the beginning owner's equity.

The second program included in the package is XRATE. XRATE produces a year-end analysis of each team's performance. Quantitative techniques are used in XRATE to rank the firms on the basis of their rate of investment. XRATE provides measurements for both players and game administrators, the latter being provided as an objective report on the progress of the game.

Student manual (161 pages); software (2 batch FORTRAN programs, 309 and 92 lines of code, with modified history file handling which eliminates the need for punched cards).

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FINANSIM: A FINANCIAL MANAGEMENT SIMULATION
(financial management, cash budgeting, ratio analysis)

Suggested Courses: Managerial Finance, Corporate Finance

$MSC035 Batch FORTRAN

Paul Greenlaw and Wm. Frey, International Textbook Co., Scranton, PA., 1967.

FINANSIM provides simulated experience in financial management decision-making and problem-solving. It may serve as a frame of reference or focal point for those courses which include the subjects of analysis of financial statements, cash budgeting, capital budgeting, ratio analysis and the like. FINANSIM enables the student to study and to apply basic analytical concepts and tools in a systematic fashion.

Each FINANSIM firm produces and sells an unnamed, unidentified product. For each period of play, which represents one year, FINANSIM managers make a number of decisions:

1) to determine the number of production units to be manufactured;
2) to purchase or sell marketable securities;
3) to float new or retire existing 10 year debentures;
4) to obtain bank-term loans to help finance company operations;
5) to issue new common stock;
6) to make dividend payments on existing common stock;
7) to maintain or expand the firm's plant and machine capacity; and
8) to invest in any or all of 3 different types of capital improvements each period which will effect future savings for the firm by reducing its operating costs.

The substantive issues presented in the FINANSIM text are:

Chapter 3
emphasizes objective attainment, to ROI, the DuPont Formula, and ROE as profitability measures, and the current ratio as a liquidity measure.

The basic FINANSIM decision problem areas are discussed: the acquisition and investment of funds, and the timing of the firm's cash inflows and outflows.

Chapter 4
introduces the student to financial planning. Illustrates how to develop pro forma income and position statements and cash budgets. Attention is given to some of the values and limitations of the financial projections; some different ways of sequencing the projections are suggested; and the development of multiple projections by means of marginal analysis is illustrated.

Chapter 5
introduces the student to investment decision making. A general discussion of capital budgeting models and their applicability to FINANSIM decision making is first provided. Then, a detailed discussion is presented showing specifically how both payback and present value analysis may be directly applied in the evaluation of FINANSIM capital improvement decisions. The chapter also focuses on the firm's investment decisions concerning plant capacity, machine capacity, and production.

Chapter 6
discusses and analyzes the four types of external sources of funds available--notes payable, bank term loans, debentures, and common stock.

Chapter 7
discusses the firm's debenture retirement and refunding, dividend, and marketable securities decisions.

Student manual (200 pages); Instructor manual available from publisher; software (batch FORTRAN program, 900 lines of code with revised history file handling which eliminates the need for punched cards).

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MARKETING IN ACTION: A DECISION GAME
(marketing management, production management)

Suggested Courses: Introductory Marketing, Marketing Policy and Planning

#MSC048 Batch FORTRAN

Ralph Day and Thomas Ness, Richard D. Irwin, Inc., Homewood, IL., 1973.

This business game provides a realistic business context for students to test marketing decisions, such as:

purchasing marketing research studies
setting prices
making product line decisions
scheduling production
allocating promotional dollars to both advertising and sales.

The instructor can vary parameters in the environment and the number of teams (3 to 6) and regions (up to 99). This capability allows adaptability in the application of the program which is especially useful for teaching introductory marketing. Little or no computer background is required for effective use.

Students form teams to manage competitive hypothetical firms within a simulated market environment. Each management group operates a well defined industry based upon information on resources and limitations of the firm, the general nature of the environment in which it must operate, general information about its competitors, and the rules for play of the game. The game continues for a number of rounds representing stages in years of operation. Each team's independent management decisions are fed into the computer which calculates firm performance in the context of competitors' decisions and market conditions as defined by the program's computational structure. In order to succeed in this game, a team must learn how a business executive makes marketing decisions and how to evolve and maintain an effective strategy for firm operation.

Student Manual (61 pages); Instructor's Manual available from publisher; software (batch FORTRAN program, 1000 lines of code).

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SIMQUEUE - A QUEUEING SIMULATION MODEL
(queueing theory, first-in/first-out)

Suggested Courses: Quantitative Techniques

#MSC039 Batch FORTRAN

Gary Wicklund, The University of Iowa, Iowa City, IA., 1969.

This computerized model is designed to teach theoretical concepts of queuing theory by allowing students to manipulate input data and observe changes in output of the system. The SIMQUEUE program simulates a system consisting of parallel single server channels with first-in, first-out queues, providing information on:

the relationship of different queue waiting times
service times
arrival rates
number of service stations
arrival distributions
service distributions

cost of servers
cost of units waiting for service.

This unit allows questions about queueing system problems to be formulated and analyzed on an individual basis. Students may vary the number of servers and the nature of the arrival/service distributions at each time period in order to produce realistic simulations of the process. The package is suitable for use in advanced undergraduate or graduate level courses teaching quantitative techniques.

Student Manual (57 pages); software (batch FORTRAN program, 900 lines of code).

TEMPOMATIC IV: A MANAGEMENT SIMULATION
(production management, business policies)

Suggested Courses: Business Policy, Production Management

#MSC042 Batch FORTRAN

Olice H. Embry, Alonzo J. Strickland, and Charles R. Scott, Houghton Mifflin Co., Boston, MASS., 1974.

TEMPOMATIC IV is a business game designed as a teaching tool for the integration of the major functional areas of business: accounting, finance, production, marketing, and economics. The instructor is given options for determining the complexity of the game, thus making it applicable at the undergraduate and graduate levels. Instructor options include:

1) selection of any one of nine demand curves;
2) selection of sales potential;
3) weighting variables such as: national advertising, local advertising, salesmen, product improvement, and sales price change effect.

Students form management teams (maximum, 15) or companies and make decisions for the 3 areas or branches of the company producing and marketing an unidentified product. The students, through their decisions, control:

1) national and local advertising;
2) number of salesmen (hired and discharged);
3) product improvements;
4) sales price (range $25 to $37);
5) transfer among 3 areas of warehouse goods;
6) raw material orders;
7) plant construction or purchase;
8) declared dividends;
9) marketing information purchased;
10) production of units;
11) short-term investment;

12) stock issues and stock retirement;
13) long-term loans;
14) bonds;
15) production pay, overtime, hiring cost.

Grading of students' performance is based upon each company's ranking on (1) sales (dollar volume), (2) income before taxes, (3) return on sales, (4) return on assets, and (5) stock price.

TEMPOMATIC IV also includes a "checker" program which checks student decision cards for correctness before being processed by the simulation.

Student manual (77 pages); Instructor's Manual (63 pages); software (batch FORTRAN program, 3000 lines of code, with revised history file handling which eliminates the need for punched cards).

MATHEMATICS

COMPUTER ORIENTED COURSE IN LINEAR ALGEBRA, A
(linear algebra, echelon, reduced echelon, orthonormal bases, polynomial coefficients, simplex method)

Suggested Courses: Linear Algebra

*MTH002 Batch FORTRAN

Donald McLaughlin, The University of Iowa, Iowa City, IA., 1974.

This text includes topics in linear algebra utilizing computing to help teach introductory students (1) some of the theory and main results of linear algebra, and (2) the algorithmic nature of relevant topics--vector spaces, systems of linear equations, matrices, linear transformations, and linear programming. Students are requested to write simple computer programs to implement the proofs of important theorems utilizing four strategic FORTRAN subroutines and a simulation supplied by the author. The programs include:

ECHLN- A subroutine which transforms a real matrix to echelon form using elementary row operations. (52 lines of code)

REDECH- A subroutine which transforms a real matrix to reduced echelon form using elementary row operations. (58 lines of code)

GRAM- A subroutine which uses the GRAM-SCHMIDT process for finding orthonormal bases within a finite dimensional inner product space, given any basis for that space. (24 lines of code)

CHAREQ- This subroutine finds the coefficients of the characteristic polynomial corresponding to a given real square matrix. (36 lines of code)

SIMPLEX- The simplex method is simulated for solving linear programming problems. (145 lines of code)

By writing computer programs to present constructive proofs of results, students must understand the structure of each argument. Using the above subroutines in individual programs also allows the student to perform routine but extensive calculations that would be prohibitive if done by hand. In addition, by solving problems on the computer, the student is led to make conjectures on the nature and structure of relationships in linear algebra.

Student Manual (180 pages); software (5 batch FORTRAN subroutines, ranging in size from 23 to 25 lines of code, and 1 batch FORTRAN program, 168 lines of code).

LABORATORY MANUAL FOR PROBABILITY AND STATISTICAL INFERENCE
(probability, statistics)

Suggested Courses: Mathematical Statistics

#MTH036 Batch FORTRAN

Elliot A. Tanis, Hope College, Holland, Michigan, 1972.

This manual contains more than 250 exercises in mathematical probability and statistics, including 25 complete solutions. It was designed for a weekly two-hour computer-based laboratory held in conjunction with a year-long course in probability and statistics having a calculus prerequisite. Solutions of exercises by students and instructors could provide examples for classroom demonstrations. The material is of sufficient generality and flexibility so that it can be used with a variety of traditional texts. However, the material does parallel the textbook Probability and Statistical Inference by Robert V. Hogg and Elliot A. Tanis. The topics in the manual, by chapter, are:

Probability
Distributions of the Discrete Type
Empirical Distributions
Distributions of the Continuous Type
Basic Sampling Distribution Theory
Distribution-Free Confidence Intervals
Estimation with Normal Models
Tests of Statistical Hypotheses
Multivariate Distributions
Chi-Square Tests of Models
Analysis of Variance
Transformations of Random Variables

The exercises are designed to illustrate the simulation of physical experiments, to elucidate theoretical concepts, and to facilitate independent student experimentation. Computer use involves student programming in FORTRAN IV, although 58 subroutines or functions are available as "canned" statistical tools for program preparation. The ultimate goal of the laboratory is to provide students with the tools and skills for conducting their own independent research.

Student Manual (298 pages); software (58 batch FORTRAN subroutines, ranging in sizes from 17 to 253 80-character lines of code).

PHYSICS

ICBM I: INTRODUCTORY COMPUTER-BASED MECHANICS I
(mechanics, numerical integration)

Suggested Courses: Introductory Physics

#PHY053 Interactive BASIC or FORTRAN

Alfred Bork, Arthur Luehrmann, and John Robson, CONDUIT, Iowa City, IA., 1976.

This package seeks to illustrate how a teacher of physics might use the computer to advantage in an introductory physics course. The segment of curriculum presented comprises one week of instruction in the physics of the harmonic oscillator, without calculus, for either physics or nonphysics majors. The authors believe that knowledge of the unique conceptual advantages and problems of the computer should be acquired early in the physics curriculum if the computer is to become a fundamental part of the physicist's problem-solving repertoire. The authors do not intend this unit to supplant the standard mathematical analysis which has traditionally accompanied the physics curriculum, but rather to complement the mathematics by enabling the student to explore a broader range of more meaningful problems. Thus, the student's lack of mathematical sophistication would no longer restrict the student and teacher to the classical "setpiece" problems of physics.

The authors' aim is to teach as much mechanics as possible to students who have no knowledge of calculus and differential equations. In particular they would like to expose students to important material that is generally omitted from elementary classical mechanics, because the students lack analytic or computational capability.

The course is organized into three lectures ("Day One" through "Day Three"), and a laboratory session. A Student Manual and a Teacher's Guide are included in the package. Day One develops the basic first-order numerical integration scheme for computing velocity and position from a knowledge of acceleration and initial conditions.

Day Two goes on to discuss the nature of computers and their languages, and the construction of algorithms for computation. The case in point is harmonic oscillation under the Hooke's Law linear restoring force; the problem is appropriately scaled and a flow chart constructed for the basic computational loop.

Day Three is available in four different versions, one for each of four computer languages: BASIC, FORTRAN, JOSS, and PL/1. In Day Three, the structure of the programs is explained in detail and computations performed. The emphasis is not on the language per se, but on the analysis; the language is discussed only as needed for the analysis. The work is extended to cover the damped harmonic oscillator problem, a subject customarily not treated before the second year of physics cum calculus.

The authors prefer using a time-shared teletype terminal or a small, readily accessible computer which will be immediately available to students

during the laboratory session and provide them with the experience of direct interaction with the computer. This type of arrangement enables the students to freely change the nature of the forces or initial conditions and to observe the effects of these changes at once, without loss of continuity or interest.

Student Manual (54 pages); Teacher's Guide (55 pages); software (programs are listed in the text in BASIC, FORTRAN, JOSS, and PL/1).

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ICBM II: INTRODUCTORY COMPUTER-BASED MECHANICS II
(mechanics, Newton's Second Law, projectile motion, Kepler's Laws, gravitational force)

Suggested Courses: Introductory Physics

#PHY092 Interactive BASIC and FORTRAN

Alfred Bork, Wayne Lange, John Merrill and Herbert Peckham, CONDUIT, Iowa City, IA., 1974.

ICBM II focuses on the iterative solution of Newton's Second Law (F=ma) using two and three dimensional solutions and introducing advanced numerical techniques with exercises for teaching students to apply concepts and skills. Topics covered include: (1) algorithmic solution of Newton's Second Law, (2) projectile motion, (3) satellite motion around a single gravitational force center, (4) Kepler's Laws, (5) satellite motion in a system with two fixed gravitional force centers, and (6) alternate calculations of Newton's Second Law using potential instead of force. Computer programs are supplied in the text for problem solutions in APL, FORTRAN, and BASIC. Students may perform calculations using or modifying one version of the following programs:

1) Motion in a Gravitational Force (approximately 30 lines of code).
2) Motion via the Potential Function (approximately 35 lines of code).

Student Manual (38 pages); software (programs listed in the text in APL, FORTRAN, and BASIC).

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MECHANICS
(physical mechanics, velocity, displacement, Newton's Second Law)

Suggested Courses: Introductory Physics

*PHY057 Interactive BASIC

Herbert Peckham, Scientific Press, Palo Alto, CA., 1972.

Peckham's twenty-eight computer-oriented exercises supplement traditional instruction in mechanics, allowing students to progress through increasingly difficult computer-oriented problems while developing logical, analytical tools, and BASIC computing skills. Simple BASIC programs which serve both as illustrative and calculation tools include:

- Average Velocity (11 lines of code)
- Displacement (13 lines of code)
- Newton's Second Law (21 lines of code)

In many cases these small programs are built upon or modified by the student in working through lab exercises. Applied calculus is involved in many different approximations, re-enforcing the student's experience with calculus, and expanding the variety of mechanics problems possible. Topics include:

- Rates
- From Rates to Displacements
- Newton's Second Law
- Half Step Method
- The Harmonic Oscillator
- More Complicated Forces
- Orbital Motion

The text is intended for use in introductory physics to enrich student understanding of mechanics, and requires student background in calculus and BASIC.

Student Lab Manual (32 pages); Teacher's Advisor (30 pages); software (programs listed in the text in BASIC).

NEWTON
(Newton's Laws, gravitation, velocity)

Suggested Courses: Introductory Physics

*PHY130 Interactive BASIC

J. Harris, Chelsea Science Simulation Project, Chelsea College, London, 1975.

Newton suggested that a stone thrown with sufficient speed from the top of a mountain would go into orbit around the earth. While students are unable to attempt this experiment, a computer can be used to work out what would happen if it was performed. The computer program on which this unit is based enables students to investigate how the path taken depends on the height of the mountain and the initial speed. The student is challenged to find the initial velocity needed for the minimum (circular) orbit, and to compare the period and shape of orbits of different sizes with data for earth satellites. The simulation especially encourages students to think about the relationship between models (in this case, Newton's Law of Gravitation and his Second Law of Motion) and the physical phenomena these models "explain".

Students' Notes (10 pages); Teachers' Guide (11 pages); software (interactive BASIC program, 122 lines of code).

QUANTUM MECHANICS
(quantum mechanics, Schrodinger's equation)

Suggested Courses: Introductory Quantum Mechanics

#PHY006 Interactive BASIC

John B. Merrill, Scientific Press, Palo Alto, CA., 1974.

This text emphasizes ways the computer can extend the student's knowledge of introductory quantum mechanics beyond ordinary analytic methods. The unit presents numerical solutions to Schrodinger's equation, many of which cannot be handled by analytic methods. Each chapter of the text starts with a brief discussion of the physics and then moves on to an explanation of the numerical procedure used on the computer giving a sample solution and exercises with two levels of complexity. The major topics discussed in the text are:

One-dimensional bound states
Three-dimensional bound states
One-dimensional, time-dependent Schrodinger equation for time-dependent potentials
Three dimensional continuum states for spherically symmetric potentials

The unit includes thirteen BASIC programs of an average length of thirty lines. Also included is a plotting subroutine which can be appended to allow printing programs to plot. A plotter, CRT terminal, or teletype should be available for plotting.

The unit assumes knowledge of introductory quantum mechanics, specifically analytic solutions for the infinite square well, and matching wave functions at boundaries.

Student Manual (77 pages); software (programs listed in the text in BASIC).

SCATTER
(nuclear scattering)

Suggested Courses: Introductory Physics

#PHY129 Interactive BASIC

J. Harris, Chelsea Science Simulation Project, Chelsea College, London, 1975.

Physics has to do with the read world, but in some cases, an actual experiment is not possible to carry out in the real world. An example is nuclear scattering, which reveals the shape and size of an object which cannot be seen. As there are experimental difficulties in performing certain scattering investigations, models of a number of experimental situations have been programmed for a computer simulation. By working with these models, the student will be able to gain insight into scattering experiments.

There are three computer programs associated with this unit which simulate various systems. The first two give students experience in deducing the size, shape and forcelaw of a single scattering center from the scattering pattern it produces. The last part simulates the scattering of alpha particles by a metal foil. Furthermore, by creating a simple physical model, or perhaps a variety of models, in the computer program and letting the student investigate the behavior predicted by the models under the different conditions, it is possible to focus his or her attention on this essential aspect of physics as model building.

The educational aims of SCATTER are to show students that one can learn about the nature (shape, size, etc.) of an object from the way it scatters particles; to increase their understanding of the use of models in physics; and to give some appreciation of the work of Rutherford, Geiger, and Marsden.

Students' Notes (15 pages); Teachers' Guide (17 pages); software (3 interactive BASIC programs, ranging in size from 132 to 159 lines of code).

SOCIAL SCIENCES

CHANGE AGENT
(change agent, diffusion of innovation)

Suggested Courses: Social Psychology, Mass Communications, Social Change

#SOC097 Interactive BASIC

Charles Weinberg, Stanford University, Stanford, CA., 1973.

A change agent is a professional who influences the innovation-decision processs in a direction deemed desirable by an employing agency, such as agricultural extension agencies, the Peace Corps, sales agencies, schools, and so forth. The innovation-decision process is the mental process through which an individual passes from first knowledge of an innovation to a decision to adopt or reject, and to confirmation of this decision.

CHANGE AGENT is a computer-based simulation game designed to convey to students an understanding of the role of a change agent and the strategies typically used by the change agent to accomplish diffusion of innovation. The game allows the student to assume the role of a change agent and to develop a planned strategy for influencing change in a hypothetical community.

The scenario for the game is a rural village of 100 farm households, divided into ten cliques, with an opinion leader for each clique. The information available to the player concerning the villagers' behavior include:

How much influence the opinion leader has.
Percentage of villagers reading newspapers.
Percentage of villagers listening to the radio.
Percentage of villagers who will attend a public meeting.
Percentage of villagers who will attend a demonstration.
Percentage of villagers who can read and write.
Number of villagers who have adopted the innovation at any point during play.

Information is also provided regarding diffusion strategies to motivate villagers to adopt the innovation. Diffusion strategies available to the player are:

Talk to an opinion leader.
Use newspapers to create knowledge of the innovation.
Use the radio to create knowledge of the innovation.
Talk to a villager at random.
Give a lecture at a public meeting about the innovation.
Show a film about the innovation at a public meeting.
Conduct a demonstration of the innovation on an opinion leader's farm.

The goal of the game player is to achieve a high level of adoption within the society in a short period of time (e.g. 50% adoption in 250 days). Thus, the performance of the player, evaluated on that basis, depends upon how wisely resources are allocated in obtaining information

and selecting strategies for change in the community. Chance events are written into the simulation and introduced to the student during actual play so as to include miscellaneous environmental effects on the system and enhance the reality of the simulation.

A computer file is established by each player to "save" his or her game. Therefore, any time during the course of the game, the player can leave and return later, picking up at the point left off.

CHANGE AGENT teaches the basic functions of a change agent, and facilitates student understanding of the theory of innovation diffusion and its application to developing societies. The game could be useful in courses dealing with social psychology, social organization, social change, mass communications, and community development. The game also has potential for training change agents.

CHANGE AGENT is an extension of a paper and pencil game developed by Evert Rogers ("The Change Agent," Chapter 7, Communication of Innovations, The Free Press, 1971).

Student Manual (11 pages); Instructor's Guide (12 pages); software (376 lines of code).

CHANGING ATTITUDES TOWARD INTEGRATION
(public opinion, social change, ethnic relations, research methods, survey analysis)

Suggested Courses: Social Psychology, Introduction to Political Science, Research Methods

#SOC019 data file

G.R. Boynton, The University of Iowa, Iowa City, IA, 1972.

The basic objective of The Changing Attitudes Toward Integration package is to place introductory sociology students in an environment where they may easily pose and answer questions about empirical relationships in the social world. The package seeks to develop analytical skills by assisting students in the discovery process. Using this approach, students learn to form and test hypotheses, while they gain experience in using the computer in modern sociological research.

The Changing Attitudes Toward Integration data set contains variables from three national opinion surveys conducted in 1946, 1966, and 1972, by the National Opinion Research Center of the University of Chicago and deals with attitudes of Whites towards Blacks. The data are grouped into two subfiles, one with the variables from the 1946 and 1966 studies and another with variables from the 1972 study. The files are comparable and may be used separately or together in analyses. However, the 1972 file contains several new variables (relating to busing and integrated neighborhoods) which are not found in the 1946 and 1966 file. Altogether there are 37 variables with 1410 respondents in the three studies.

The analysis areas the student investigates include: change in White attitudes toward Blacks, generations and attitudinal change, education and attitudinal change, and attitudes toward busing and integrated neighborhoods.

Student Manual/Codebook (44 pages); Notes to Instructor (8 pages); software (data file with variable labels (37 variables, 1410 cases) for use with SPSS or a similar statistical analysis package).

CITIZENS AND THE POLITICAL SYSTEM
(comparative politics, research methods, survey analysis)

Suggested Courses: Comparative Politics, Research Methods, Introductory Political Science

#SOC020 data file

G.R. Boynton, The University of Iowa, Iowa City, IA, 1972.

The data set for Citizens and the Political System is a subset of items from a survey on public attitudes toward government by Gabriel Almond and Sidney Verba as reported in The Civic Culture. Approximately 1000 people were interviewed in the United States, Great Britain, West Germany, and Italy using the same set of questions. For purpose of analysis, the countries may be looked at separately or in any combination. To these items were added a set of items taken from the Iowa Legislative Research Project in which approximately 1000 Iowans were interviewed. Most of these questions are different from those in the Almond-Verba study which prohibits a combined analysis using both sets of data.

The student manual contains several fixed lessons which teach students how to answer questions with empirical data. A second stage is represented by several lessons which ask the student to devise methods for answering certain questions. Finally the student is free to formulate his own questions. Among the questions the student investigates are: How central is politics to citizens?, How do citizens think the political system ought to operate?, and How do citizens participate in the political life of their country?.

Student Manual/Codebook (53 pages); Notes to Instructor (8 pages); software (data file with variables (65 variables, 2000 cases) for use with SPSS or a similar statistical analysis package).

COGNITIVE PSYCHOLOGY: A COMPUTER-BASED LABORATORY MANUAL
(cognitive processes, pattern recognition, concept learning, memory)

Suggested Courses: Experimental Psychology, Learning Memory, Human Information Processing

#SOC051 Interactive BASIC

Wm. Bewley, Project COMPUTe, Dartmouth College, Hanover, N.H., 1974.

The intention of this laboratory manual in Cognitive Psychology is to facilitate innovative learning by using the computer to help students develop internal (mental) models of reality, test these models against reality, and correct or refine the model if errors are found. No background in computer programming is required because information-processing operations appropriate for a certain class of models (e.g., queueing models), are already programmed into the models. Six experiments, chosen to cover the range of cognitive activity represented in the current general conception of human information-processing systems, are presented for students to simulate. For each of these 30 to 60 minute experiments, program listings, documentation, and questions are supplied to lead the student into running a simulation and comparing computer-oriented results to underlying processes. These experiments, involving programs with a number of options, include:

Pattern Recognition
Partial replication of search experiment of Neisser (1963);

Short-Term Memory
A test of the buffer model of Atkinson and Shiffrin (1968);

Long-Term Memory
Paired-Associate Learning demonstrates an experimental analogy of the learning of morphological rules (Palermo and Eberhart, 1968);

Stimulus and Association Learner
Demonstrates a discrimination-net model of long term memory (Hintzman, 1968);

Concept Learning
Provides a test of several "hypothesis" theories of concept learning;

Decision Making
Concerned with decision making in a social context. Using data obtained from repeated plays of a two-person game (similar to Prisoner's Dilemma Game), the program will provide a test of a model which attempts to account for both intrapersonal and interpersonal conflict in making decisions. Based on the social motives theory of Messick and McClintock (1968) and a stochastic learning model of choice behavior described by Rapoport and Chammah (1965);

Problem Solving
The missionaries and cannibals problem is solved by both a human subject and a simulation of GPS, the General Problem Solver

(Ernst and Newell, 1969), and the performance of each is examined in an attempt to determine the adequacy of GPS as a model of human thought.

The major potential problem in implementing these programs on the computer is timing. Measuring the response latency of the subject (user) is an integral part of several of the experiments. If this measurement cannot be made accurately the data may be too crude to be of any use. If a system is not designed for time-sharing and is faking it through a batch operating system, the response time of the system may be several seconds. Since this may be the same order of magnitude as the response time of the subject, the system response contributes a random variation that may conceal any trend in the subject's response latency.

For best results, these programs should be run on a time-sharing system that responds in approximately a second during peak job load. A timing box which controls the flow of data and resets the timer to zero may be attached to the terminal to overcome any response time problems.

Student Manual (102 pages); Instructor's Manual (96 pages); software (6 interactive BASIC programs, ranging in size from 150 to 290 lines of code).

●

NORC75: 1975 GENERAL SOCIAL SURVEY
(social opinion, stratification, race relations, family)

Suggested Courses: Stratification, Marriage and the Family, Race Relations, Urban Sociology, Social Changes, Social Psychology

#SOC112 data file

National Opinion Research Center, University of Chicago, and Roper Public Opinion Research Center, Williams College, 1975.

NORC75 is the fourth in a series of surveys conducted by the National Opinion Research Center. This most recent survey was conducted during March and April of 1975 and includes 1,490 interviews with a median length of 60 minutes. Included in the 253 variables in the data set are responses to specific questions on such controversial issues as women's roles in today's society, abortion, capital punishment, and changing attitudes. The data come from interviews administered to NORC national samples, using a standard questionnaire with all but one item asked in other years. The sample is a national cross-section of adults, 18 years of age and older.

The content is deliberately eclectic. The aim of NORC is to cover the mainstream interests of sociologists, with special attention given to topics that are relevant to substantive courses. NORC's basic purposes are (1) to generate data trends (and constants) in social characteristics and opinions, and (2) to make fresh, interesting, high-quality data available to social scientists and students who are not affiliated with large research centers.

The data can be used in class work to ask students to test hypotheses derived from readings and lectures. Methods classes can use the data for practice in analysis. Many content areas have enough items for exercises on scale and index construction.

Student Codebook (176 pages); Technical Documentation (9 pages); software (data file with variable labels (253 variables, 1490 cases) for use with SPSS or a similar statistical package).

OPTIMAL LOCATION OF FACILITIES
(locational analysis)

Suggested Courses: Introductory Geography, Intermediate Geography

#SOC091 Batch FORTRAN

Gerard Rushton, Department of Geography, The University of Iowa, Iowa City, IA., 1975.

The laboratory manual, Optimal Location of Facilities, is suited for either introductory or advanced geography. It focuses on locational analysis using a prescriptively oriented approach rather than traditional inductive statistical analyses. The text is organized into substantive discussion, handworked examples, student exercises, and computerized algorithms. Chapters include:

I. The Location Problem
   1. Application of Optimal Location Procedure
   2. Classification of Location Problems
   3. Methods for Solving Location Problems
II. The Single-Source Location Problems
   1. Locations in Continuous Space
   2. Locations on a Route Structure
III. Multi-Facility Location in Continuous Space
IV. Multi-Facility Location on a Network
   1. Minimizing Average Distance
   2. Minimizing the Maximum Distance to Closest Supply Centers in a System
   3. Minimizing the Number of Centers Required for Every Demand Point to be Within a Critical Distance of a Supply Point
   4. Minimizing Average Distance Subject to a Maximum Distance Constraint
V. Shortest Paths through a Network

These chapters are designed to introduce students to increasingly difficult topics in location theory as a prescriptive science, while developing student skills in thinking through and performing locational analyses. Small problems and hand calculations are stressed so that the

complexity of location problems are realized before the student uses the computer programs.

The accompanying FORTRAN programs documented in Computer Programs for Location-Allocation Problems (edited by G. Rushton, M. Goodchild, L. Ostresh, Monograph Number 6, Department of Geography, The University of Iowa, Iowa City, Iowa 52242, 1973) include:

WEBER
exact solution to the one source location problem (198 lines)
TWAIN
exact solution to the two source location-allocation problem (284 lines)
MULTI
exact solution to the M-Center location-allocation problem (783 lines)
ALTERN
heuristic solution to the M-Center location-allocation problem (230 lines)
TORNQUIST
heuristic solution to the M-Center location--allocation problem (256 lines)
LAP
location-allocation package by Goodchild (695 lines)
MAPTRANS
multiple facility location for a continuous demand surface (538 lines)
SPA
shortest path algorithm (731 lines)
ALLOC
heuristic solutions to multi-facility location problems on a graph (490 lines)
INTPMED
evaluation of student solutions to location problems on a network (327 lines)
WARELOC
heuristic program for locating warehouses with facility costs (340 lines)
PRESLOC
calculates the costs of the present warehouse locational configuation for any configuration input by the user (204 lines)
REVPREF
paired comparisons analysis of spatial stimuli types from spatial choice (1159 lines)
PCPA
statistical comparison of paired comparison preference matrices (1599 lines)

Laboratory Manual (160 pages) and Computer Programs for Location-Allocation Problems (321 pages);software (14 batch FORTRAN programs, ranging in size from 198 to 1600 lines of code).

POLITICAL PARTICIPATION
(political participation, voting behavior, socio-economic status)

Suggested Courses: Introductory Political Science, Political Behavior, American Government

#SOC132 data file

C. Atherton and H. Hahn, American Political Science Association, Washington, D.C., 1975.

In this module on political participation, the opening discussion presents the relationship between socioeconomic status and participation; first with voting, and subsequently, with other modes of participant behavior, after discussion of the limitation of exclusive attention on voting. Students are guided through the testing of propositions taken from the literature on the modification upon the SES (socio-economic status) relationship made by "life experiences" (e.g., sex, group membership, etc.) and cognitions (e.g., efficacy, group consciousness, salience, etc.). Students are then asked to control for race and explore the differences which emerge. These differences lead to consideration of nonparticipation and nonlegitimized behaviors (e.g., riots, demonstrations) as rational strategies for certain individuals.

Student Manual/Codebook (75 pages); software (data file with variable labels (66 variables, 1558 cases for use with SPSS or a similar statistical package).

POLITICAL SOCIALIZATION ACROSS THE GENERATIONS
(political socialization)

Suggested Courses: Political Behavior, Introductory Political Science, American Government

#SOC133 data file

P.A. Beck, J.W. Brunner, and L.D. Dobson, American Political Science Association, Washington, D.C., 1975.

This package, dealing with political socialization, gives students access to a unique set of data, interviews with parents and their children conducted in 1965 and the reinterviews with these same parents and children in 1973. The research was directed by M. Kent Jennings, Center for Political Studies, University of Michigan. The members of the younger of

the two related generations were high school seniors in 1965. Students formulate hypotheses about which a series of political views (including party identification, presidential vote preference, cynicism, attitudes towards school integration, and political efficacy) are most likely and least likely to be transmitted from parents to children before the child leaves home. These hypotheses are tested using the 1965 data. Then the students formulate hypotheses about which of these political views are most likely and least likely to remain similar for parents and their children after the children have become adults. These hypotheses are tested using the 1973 reinterviews.

More advanced exercises are provided which involve the student in analyses of parent and child change over this turbulent eight-year period, and in the use of control variables. All but the advanced work can be done conveniently using percentages.

Student Manual/Codebook (86 pages); software (data file with variable labels (139 variables, 1062 cases) for use with SPSS or a similiar statistical analysis package).

PUBLIC REACTION TO CIVIL DISOBEDIENCE
(public opinion, protest movement, research methods, survey analysis)

Suggested Courses: Social Psychology, Research Methods, Introductory Political Science

#SOC017 data file

G.R. Boynton, The University of Iowa, Iowa City, IA., 1972.

The Public Reactions to Civil Disobedience data set contains variables from a 1968 National Sample Survey of the adult U.S. Population conducted by the Survey Research Center at the University of Michigan. The variables pertain to general public reaction to the protests and demonstrations of the 1960's.

The general area of investigation in this package is the rather negative public reaction to the protest movement in the 1960's. Specific areas investigated by the students include the relationship of attitudes toward protest to certain public issues (integration, Viet Nam), the relationship of attitudes toward protest to government effectiveness, and the relationship of attitudes toward protest to various social characteristics (education, life experiences) of the respondents.

The student manual contains three practice analyses for students to run. Also included is a list of ideas for further investigation which the students should then be able to carry out in depth on their own.

Student Manual/Codebook (42 pages); Notes to Instructor (8 pages); software (data file with variable labels (48 variables, 716 cases) for use with SPSS or a similar statistical analysis package).

REPRESENTATION IN THE U.S. CONGRESS: 1973
(congressional representation, constituency representation)

Suggested Courses: American Government, Political Behavior

#SOC131 data file

R. Geigle and P. Hartjens, American Political Science Association, Washington, D.C., 1975.

Classical theories of representation, as expressed by Burke and the founding fathers, and developed by modern political philosophers, serve as a foundation for propositions about the behavior of U.S. Congressmen and Senators in the 1970's. Constitutency characteristics such as urbanism, occupation and ethnicity, electoral competition and party affiliation, ratings by a variety of interest groups, and presidential influence, provide variables for cross-tabulations in which the student tests theories of representation. These 38 variables and roll call votes on 11 major issues in the 93rd Congress are coded in simplified form to eliminate problems of data manipulation. A series of exercises explains the process and purpose of hypothesis testing with bivariate tables and the function of controls. These exercises are designed for the introductory American Government course, but the data set is comprehensive enough to derive relatively sophisticated problems for advanced classes in legislative behavior or research methods.

Student Manual/Codebook (78 pages); software (data file with variable labels (38 variables, 535 cases) for use with SPSS or a similar statistical analysis package).

SCLAB/MICROTAB
(research methods, statistics)

Suggested Courses: Research Methods in Sociology

#SOC022 Interactive BASIC or FORTRAN

Edmund D. Meyers and Robert Sokol, Dartmouth College, Hanover, N.H., 1974.

This package represents the union of two instructional capabilities in sociology. One is a simple tabulation program, MICROTAB, designed to permit students to obtain contingency tabulations from a limited set of variables. The other is a collection of ten exercises designed for use in an introductory sociology course; these exercises are published as

Laboratory Manual for Introductory Sociology: A Data Card Approach (Addison-Wesley, 1970) by Robert Sockol.

MICROTAB stores a large n-way table representing a specific data file, which can be collapsed into smaller contingency tables at the user's request. This technique provides the user with a simple-to-use cross-tabulation capability. The program outputs frequencies, percentages, and ordinal measures of association. No prior knowledge of mathematics or computer skills are required for use of this simple, relatively inflexible program, although some knowledge of research design is needed on the part of the instructor. User-supplied data can be inserted into MICROTAB for class analysis, allowing student inquiry into data bases representing various substantive areas.

As a functional alternative to a massive software package, MICROTAB has both advantages and disadvantages. By being easy to use, it can be adopted readily in the classroom. At the same time, it falls far short of the larger statistical packages with regard to power and flexibility. Given these limitations, the usefulness of the package depends, to a great extent, upon the ingenuity of the instructor in providing the right combination of data and curriculum materials.

For each of Sokol's ten exercises, two modules are available with MICROTAB: Sokol's small sample used originally with edge-punched cards (200 observations); and the full sample containing most of the observations from the original data set. The modules are:

White Attitudes Toward Misceçenation
Cross-Cultural Studies of Socialization
Social Groups and the Individual: Group Data
Social Groups and the Individual: Individuals
Social Stratification: Alienation/Success Motive
Studies in Population: Differential Fertility
Sociological Correlates of Urbanization: Counties
Sociological Correlates of Urbanization: Individuals
Correlates of Marital Maladjustment
Sociclogical Aspects of Economic Underdevelopment
Anti-Black Prejudice Among Whites
Attitude Changes Among Undergraduates

Sokol's exercises are designed tc expose beginning students to empirical research in sociology, with the following objectives in mind:

1) To demonstrate the close connection between theory and data in sociology;
2) To familiarize students with the process cf sociological analysis;
3) To stress the need for empirical verification of theoretical questions;
4) To demonstrate the selecticn of a best available explanation among competing plausible explanations;
5) To teach some elementary social research techniques; and
6) To give topics covered relevance to current sociology and to issues of the day.

Laboratory Manual for Introductory Sociology: A Data Card Approach (148 pages); acccmpanying Teacher's Manual available from Addison-Wesley. SOLAB Codebook (38 pages); MICROTAB documentation (30 pages); software (MICROTAB program (interactive FORTRAN (560 lines of code) or BASIC (445 lines of code)) and 24 data bases).

SUPREME COURT IN AMERICAN POLITICS: POLICY THROUGH LAW, THE
(judicial policy-making, judicial implementation, judicial compliance)

Suggested Courses: American Government

#SOC125 data file

J. Ryan and C. Tate, American Political Science Association, Washington, D.C., 1975.

This package, dealing with judicial policy-making and implementation, contains two data sets. The nonunanimous decisions of the Supreme Court, 1946-1969, were collected by Glendon Schubert for The Judicial Mind Revisited (1974). The remaining decisions were collected and supplied to the authors by Richard E. Johnston. Much of the background data on the justices were originally collected by John R. Schmidhauser. The observations on interrogations in New Haven were collected and supplied to the authors by Michael Wald (see his "Interrogations in New Haven: The Impact of Miranda," Yale Law Journal, 1967).

Students using this unit systematically explore the processes of Supreme Court policy-making, from decision to compliance. First, they examine the Court as an institution at different time periods (e.g., "The Warren Court"), using the Schubert data in which each decision is a unit of analysis. Decisions dealing with civil liberties and economic issues on which there was some disagreement among the justices provide students with subject matter comparisons. (There were 1,992 such cases between 1946 and 1974.) Then students aggregate the policy preferences of individual justices, focusing, for example, on the Nixon appointees, and optionally, examining voting interagreement and judicial blocs. Another exercise, using biographical and voting data, permits students to test the hypothesis that the behavior of justices is determined by their background. A second data file on compliance with Miranda in New Haven permits them to analyze variations in the implementation of one of the important decisions of the Warren Court. Techniques used are cross-tabulation, percentages and arithmetic means.

Student Manual/Codebook (88 pages); software (2 data files with variable labels (34 variables, 1992 cases) for use with SPSS or a similar statistical analysis package).

UNITED STATES ENERGY, ENVIRONMENT AND ECONOMICS PROBLEM: A PUBLIC POLICY (public policy process, environmental policy)

Suggested Courses: American Government

#SOC126 batch FORTRAN

Barry Hughes, American Political Science Association, Washington, D.C., 1975.

This simulation has both a strong substantive component and an emphasis on critically analyzing the public policy process. The student is encouraged to think in terms of alternative models of public policy, and to analyze the decision-making and policy environment elements of the total public policy process. A model of a specific policy problem involving energy, environment, and economic (EEE) issues is discussed in some depth so as to provide exposure to those issues and their interrelationships. A fairly sophisticated computer simulation version of that model is provided along with the package. The model is composed of the following elements:

1) societal, group and individual values and goals;
2) governmental structures and processes; and
3) the non-political environment (economy, physical environment and energy system).

The simulation contains data modeling the third element, thus allowing the student to examine various models representing the first and second elements and their implications in the area of environmental issues.

On the basis of what students learn in the package about past decision-making on the EEE issues, and on the basis of their old and new mental models of the decision-making process, they describe what they think the most basic elements of future EEE policy will be. (Actually, they select from a set of alternatives provided.) The students are also encouraged to make their own choices as to what policy should be. The emphasis in both cases is upon recognizing trade-offs. Both sets of decisions are then put into the computer model to see what the long-run (up to year 2000) consequences of such decisions would be.

Student Manual (52 pages); software (batch FORTRAN program, 605 lines of code).

USPOP: UNITED STATES POPULATION
(population projections, demography)

Suggested Courses: Introductory Sociology

#SOC030 Interactive BASIC

James Friedland, Huntington Two Computer Project, State University of N.Y., 1973.

USPOP uses simulation techniques as a stimulus to learning in the teaching of many key demographic concepts involving population growth and age distribution. Students play the role of demographers projecting future population trends. The Student Manual leads the student through a series of five investigations, each involving a single concept. The following concepts are explored:

INVESTIGATION #1
Effect of fertility on population growth. Fertility is seen to have a major impact on population growth.
INVESTIGATION #2
Effect of time of birth of first child on the population-growth rate. Surprisingly, delaying the birth of the first child can slow population growth, even if the total number of offspring remains constant.
INVESTIGATION #3
Effect of reducing infant mortality. Reducing infant mortality to the lowest level realistically possible is seen to have only a minor impact on future population size.
INVESTIGATIONS #4 and #5
Exploration of factors affecting age distribution in a population. Again fertility is seen as the major factor. Mortality is important, but it has only a secondary effect on age distribution in the population.

Through use of 1970 Census data, held in DATA statements, the students need enter only a few of the required inputs.
Student Workbook (21 pages); Teacher's Guide (27 pages); Resource Handbook (38 pages); software (interactive BASIC program, 265 lines of code).

VOTING BEHAVIOR: THE 1972 ELECTION
(voting behavior, electoral behavior)

Suggested Courses: American Government, Introductory Political Science

#SOC128 data file

D. Bowen, C. Broh, and C. Prysby, American Political Science Association, Washington, D.C., 1975.

This unit introduces the concepts and methods of analysis for the study of vote choice and electoral behavior based upon survey data drawn from the 1972 Presidential Election Study conducted by the Center for Political Studies, University of Michigan. These data (128 variables, 1705 cases) include measures of (1) party identification and voting behavior, (b) interest in the campaign and general political involvement, (c) personal and background characteristics, (d) political and social attitudes, and (e) feelings about candidates and parties. Students are given fairly structured analysis assignments, then directed to less structured analyses, with a variety of alternatives provided, so that the instructor may adapt the package to the time available and the sophistication of the students.

Student Manual/Codebook (75 pages); software (data file with variable labels (128 variables, 2705 cases) for use with SPSS or a similar statistical analysis package).

VOTING BEHAVIOR IN THE UNITED STATES: 1952-1972
(voting behavior, research methods, survey analysis)

Suggested Courses: Introductory Political Science, Research Methods

#SOC021 data file

G.R. Boynton, The University of Iowa, Iowa City, IA, 1972.

The Voting Behavior in the United States data set contains 49 variables from surveys conducted by the Survey Research Center at the University of Michigan immediately before or after each of the presidential elections in 1952, 1956, 1960, 1964, 1968, and 1972. The data set is organized into six subfiles (one for each year).

The general area of investigation is the decisions citizens make in choosing a president. Specific analyses performed by the students relate presidential voting to party identification, attitudes toward presidential

candidates and parties, policy attitudes, and the social characteristics of respondents.

Student manual (51 pages); Notes to Instructor (8 pages); software (data file with variable labels (49 variables, 3000 cases) for use with SPSS or a similiar statistical analysis package).

VOTING BEHAVIOR IN WESTERN EUROPE
(voting behavior, comparative politics, research methods, survey analysis)

Suggested Courses: Comparative Politics, Research Methods, Introductory Political Science

#SOC021 data file

Gerhard Loewenberg, The University of Iowa, Iowa City, IA, 1972.

The Voting Behavior in Western Europe package contains data taken from comparable surveys of the voting age public in two countries. The British survey (VOTEBRIT) was conducted shortly after a national parliamentary election was held in Great Britain in 1966 by Professors David Butler and Donald Stokes as detailed in Political Change in Britain. VOTEBRIT contains 28 variables with 917 respondents and is derived from this study. A similar German survey (VOTEGERM) was conducted by Professor Rudolf Wildemann shortly before the German parliamentary election of 1969. VOTEGERM is derived from the Wildemann study and contains 32 variables with 992 respondents. Both data sets relate to the voting behavior and political attitudes of representative citizens of each country and both sets are fully described in appendices to the student manual.

The two data sets are distinct entities and cannot be combined in an analysis although they are both used and described in the same manual. However, certain corresponding variables do exist in the data sets so that some comparisons of the two countries through separate analyses are possible. Care must be exercised because corresponding variables may have different names.

The student manual contains five practice analyses for students to run and a list of ideas for further investigation which the students should then be able to carry out in depth on their own.

Student Manual/Codebook (55 pages); Notes to Instructor (8 pages), software (2 data files with variable labels (Britain-28 variables, 917 cases; Germany - 32 variables, 922 cases) for use with SPSS or a similar statistical analysis package).

CONDUIT Computer-Based Curriculum Packages

The price for each unit and any additional texts is listed below.
Each UNIT consists of software (on magnetic or paper tape, or listed in the manual), one copy of each relevant manual, an abstract including review summaries, and instructions or notes to implementers for installing the program(s) on your computer. NOTE: The first price listed for ADD'L TEXT(s) is the price of one copy; the second, the per-copy price of multiple copies. A $50 subscription per year (July 1-June 30) entitles one to the status of subscriber, and reduced package costs. If you are neither member nor subscriber, the regular prices will apply to your order.

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MSC035	FINANSIM: A Financial Management Simulation	Regular Subscriber	$40.00 $36.00	$6.50/6.00
MSC039	SIMQUEUE: A Queueing Simulation Model	Regular Subscriber	$30.00 $27.00	$5.00/4.50
MSC042	TEMPOMATIC IV: A Management Simulation	Regular Subscriber	$50.00 $45.00	Student $6.50/5.50 Instructor $2.00
MSC048	Marketing in Action	Regular Subscriber	$50.00 $45.00	$6.00/5.50
MSC054	The Executive Game	Regular Subscriber	$40.00 $36.00	$6.50/6.00
MSC055	Business Management Laboratory	Regular Subscriber	$50.00 $45.00	$6.00/5.50
MTH002	A Computer-Oriented Course in Linear Algebra	Regular Subscriber	$30.00 $27.00	$4.50/4.00
MTH036	Laboratory Manual for Probability & Statistical Inference	Regular Subscriber	$55.00 $49.50	$6.50/6.00

PHY006	Quantum Mechanics	Regular Subscriber	$ 9.50 $9.50	$8.50/7.50
PHY053	ICBMI: Introductory Computer-Based Mechanics I	Regular Subscriber	$ 6.00 $ 5.40	Student $2.00/1.50
PHY057	Mechanics	Regular Subscriber	$ 5.00 $5.00	Student $2.00 Instructor $2.00
PHY092	ICBMII: Introductory Computer-Based Mechanics II	Regular Subscriber	$ 5.00 $5.00	$4.00/3.00
PHY129	SCATTER	Regular Subscriber	$15.00 $13.50	Student 25 for $10.00
PHY130	NEWTON	Regular Subscriber	$15.00 $13.50	Student 25 for $10.00
SOC022	SOLAB/MICROTAB	Regular Subscriber	$50.00 $45.00	Student $6.50/6.00 Codebook $6.50/6.00
SOC017	Public Reaction to Civil Disobedience	Regular Subscriber	$40.00 $36.00	$2.50/2.00
SOC018	Voting Behavior in the U.S., 1952-1972	Regular Subscriber	$50.00 $45.00	$2.50/2.00
SOC019	Changing Attitudes Toward Integration	Regular Subscriber	$40.00 $36.00	$2.50/2.00
SOC020	Citizens and the Political System	Regular Subscriber	$50.00 $45.00	$3.50/3.00
SOC021	Voting Behavior in Western Europe	Regular Subscriber	$40.00 $36.00	$2.50/2.00
SOC030	USPOP: United States Population Study	Regular Subscriber	$10.00 $ 9.00	Student $ .50 Teacher $1.00 Resource $1.50
SOC051	Cognitive Psychology: A Computer-Based Laboratory Manual	Regular Subscriber	$50.00 $45.00	$6.50/6.00
SOC091	Optimal Location of Facilities	Regular Subscriber	$60.00 $54.00	Student $6.50/6.00
SOC097	Change Agent	Regular Subscriber	$30.00 $27.00	Student $2.00/1.50
SOC112	NORC75	Regular Subscriber	$40.00 $36.00	Student $6.00/5.00
SOC125	The Supreme Court in American Politics	Regular Subscriber	$10.00 $ 9.00	Student $4.00/3.50
SOC126	U.S. Energy, Environment and Economic Problems	Regular Subscriber	$10.00 $ 9.00	Student $4.00/3.50
SOC128	Voting Behavior: The 1972 Election	Regular Subscriber	$15.00 $13.50	Student $4.00/3.50
SOC131	Representation in the U.S. Congress: 1973	Regular Subscriber	$10.00 $ 9.00	Student $4.00/3.50
SOC132	Political Participation	Regular Subscriber	$10.00 $ 9.00	Student $4.00/3.50
SOC133	Political Socialization	Regular Subscriber	$10.00 $ 9.00	Student $4.00/3.50

* Prices are subject to change at the discretion of CONDUIT.

Please send me the following materials:

PACKAGE Registry No. Title	Unit Price	Add'l Text(s) Qty.	Add'l Text(s) Unit Price	Total

PACKAGE Registry No. Title	Unit Price	Add'l Text(s) Qty.	Add'l Text(s) Unit Price	Total

TOTAL	
*(Postage: $2.00/unit)	
TOTAL	

Please make check payable to CONDUIT. Check Enclosed ☐ Bill Me ☐. Return form to: Molly Hepler, CONDUIT, P.O. Box 388, Iowa City, Iowa 52240. *Those sending prepaid orders may disregard postage fee.

The following information must be supplied in order to fill your request. You can help us assure that our packages are usable on your system by providing the information yourself, or, if you are unfamiliar with the technical specifications of your computer, by enlisting the help of a local computing expert in completing this form. Please contact us (telephone: 319-353-3170) for any additional explanation needed in completing this form, or for assistance in judging the transferability of any package to your computer.

Language conventions followed for FORTRAN programs are set forth by the American National Standards Institute (ANSI). Although our technical staff has worked to alleviate problems when transferring BASIC software, the number of differing versions of BASIC available on computers increases the likelihood of problems when transferring the BASIC units. A complete description of the language standards adopted by CONDUIT can be found in: *CONDUIT Technical Transfer Guidelines*, T. Dunnagan (ed.), 1976; and *BASIC Revisited*, G. Isaacs, 1976. Both documents may be ordered from CONDUIT.

COMPUTER (CPU) FOR WHICH PROGRAM SET IS BEING OBTAINED

Manufacturer: .....

Model: .....

Operating System: .....

Release and/or versions: .....

If package is to be sent in BASIC, state level or version used on your system: .....

TECHNICAL CONTACT

Name: .....

(Please print)

Position: .....

Telephone: .....

area code

DESIRED MEDIUM FOR TRANSFERRING PROGRAM SETS

Software for CONDUIT packages is generally supplied by CONDUIT on magnetic tape. The unit price

CONDUIT Order Form for Computer-Based Curriculum Packages

includes the price of a magnetic tape which is supplied with the package. Other media of transfer (paper tape, cards, and so forth) are available on a request-only basis.

MAGNETIC TAPE

☐ 7 track, 800 BPI, IBMEL (6-bit), 80 blocksize, 80 record length (unblocked), no labels, ☐ even parity OR ☐ odd parity.
☐ 9 track 800 BPI, 80 blocksize, 80 record length (unblocked), no labels, ☐ EBCDIC (8-bit) OR ☐ ASCII (8-bit)

MYLAR (PAPER) TAPE (ASCII)

Parity: ☐ odd ☐ even ☐ no parity
☐ always on ☐ always off

Necessary end-of-line control characters and their decimal code:

Will your system accept both files and programs from a paper tape reader?

OTHER
If none of the above are possible, please specify:

Computer

Operating System

Medium (cards, cassette)

Character Code

Please attach documentation of character code(s) available to you, giving each character and its decimal equivalent.

HELP: Your help in improving CONDUIT services by answering the following question will be appreciated. From which of the following sources did you learn about the package(s) you ordered from CONDUIT?

PIPELINE ..... In response to local request
Other (please specify):
Colleague ..... Professional journal
CONDUIT Catalog ..... Conference (please specify):

Customer Agreement

Customer agrees not to redistribute CONDUIT programs or materials. Program sets are distributed for use on a single computer (CPU): customer agrees that the software will be copied only for use on the CPU specified above. Customer also agrees to forward to CONDUIT any nontrivial changes made to, and errors detected in, the programs or materials, and to supply CONDUIT, on request, with information on the success of the implementation and use of these materials. CONDUIT assures that the programs will operate as described, and will provide programming support for implementation of materials for up to six months from date of signed agreement.

Mail to:

Customer (please print)

Customer's signature Date

Department

Institution

UPS address

City State Zip

Telephone: area code

Bill to:

City State Zip